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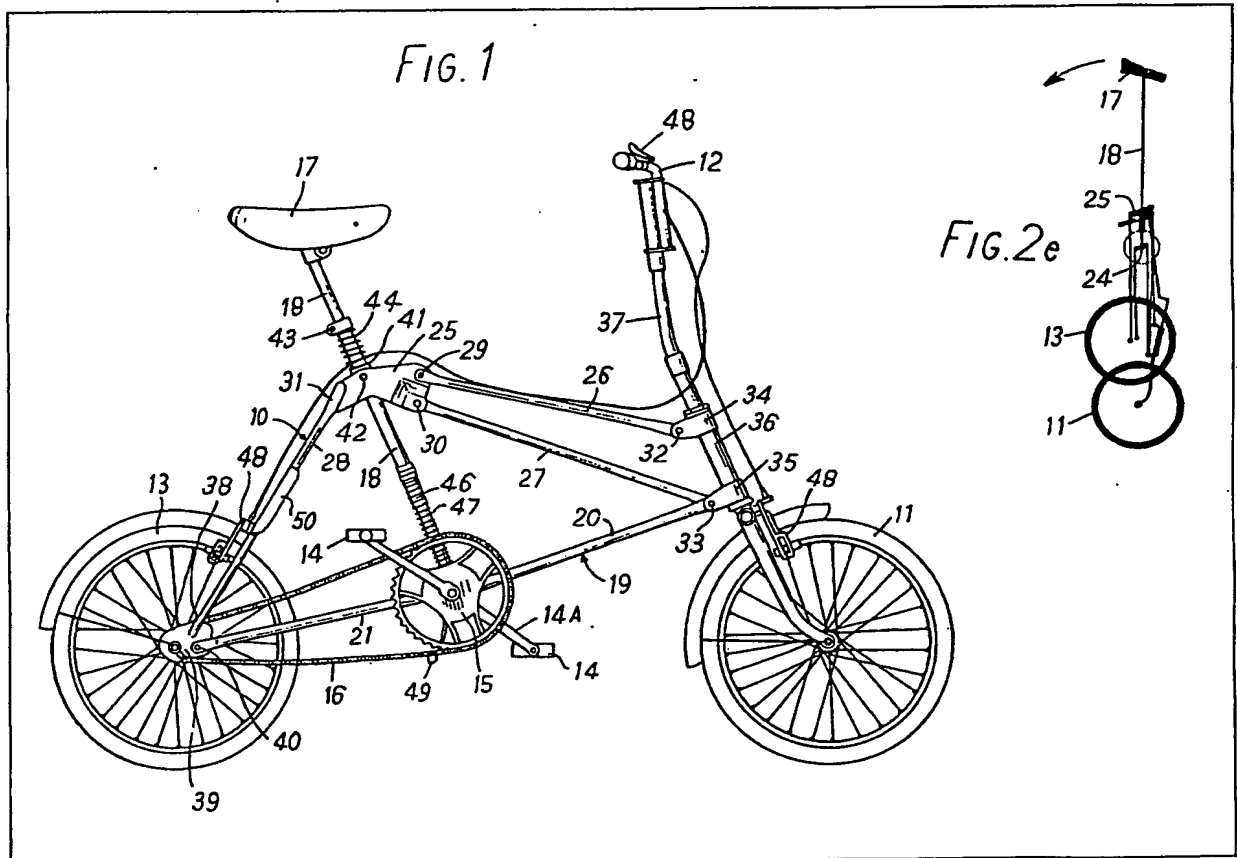
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 GB 451654  
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## (54) Folding Cycle

(57) A folding bicycle has a frame (10) comprising a base (19) formed by tie members (20, 21) pivotally connected at

their adjacent ends to a crank bracket and at their other ends to a head tube (36) and rear wheel mounting brackets (39) respectively, a joint bracket (25) which is pivotally connected to front strut members (26, 27) pivoted to the head tube (36) and which is fixed to a rigid rear strut member (28) and a support member (18) which extends from the crank bracket and through the joint bracket (25) and carries a saddle (17). The frame is foldable by raising the support member (18) to move the crank bracket towards the joint bracket and so swing the front and rear wheels downwardly into positions alongside one another, Figure 2e. The support member (18) is hinged so that the saddle (17) can be swung downwardly to lie adjacent the wheels in the folded state. Prior to folding the frame the front wheel assembly (11, 37) is turned through 180° and handlebars (12) are swung towards one another. The cycle may alternatively have three or four wheels.



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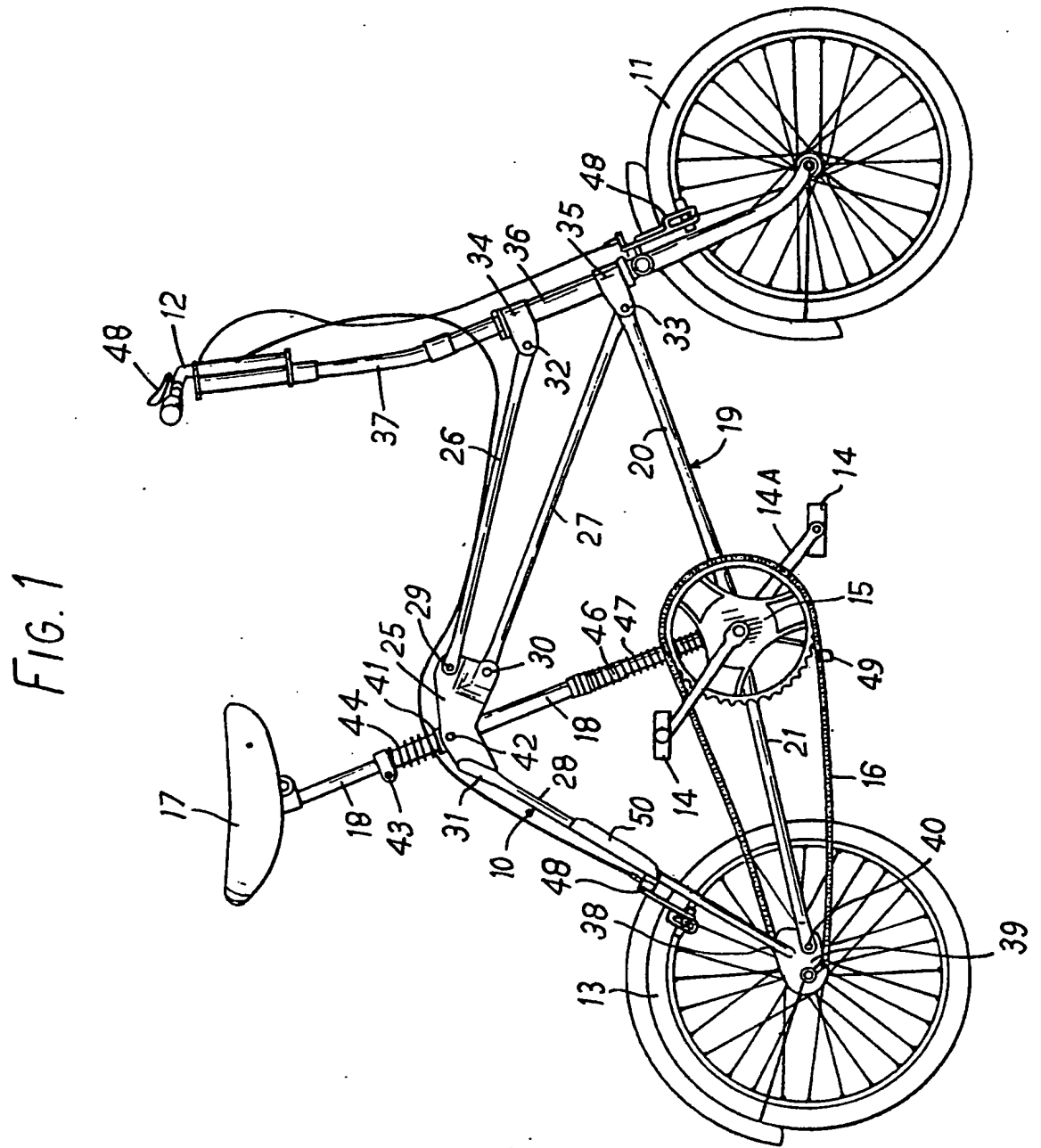


FIG. 2a

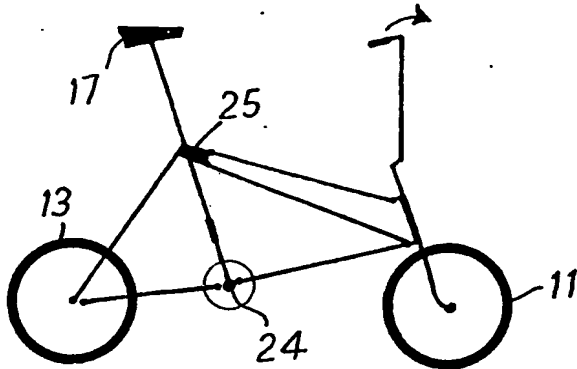


FIG. 2d

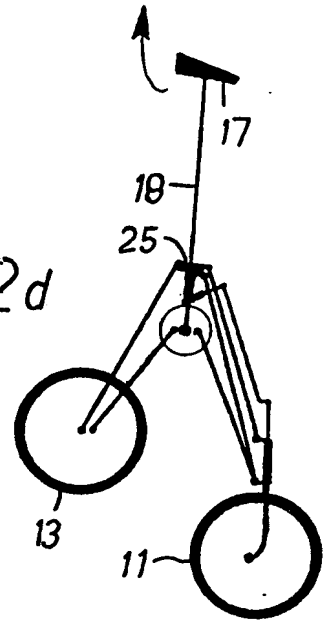


FIG. 2b

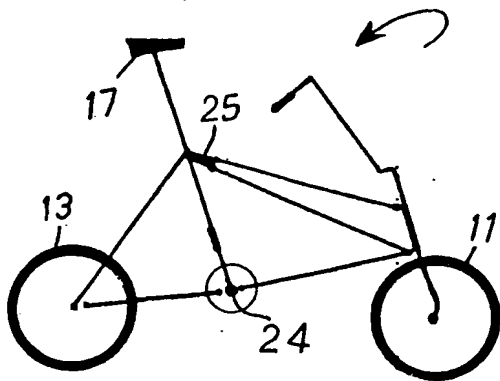


FIG. 2e

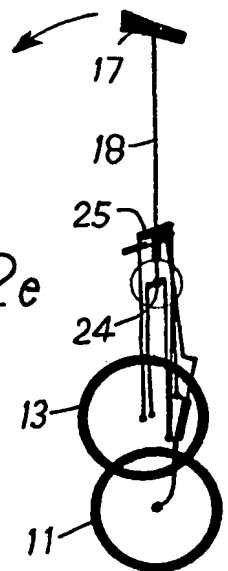


FIG. 2c

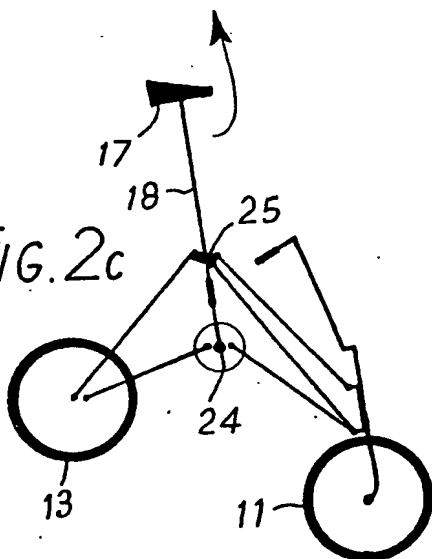


FIG. 2g

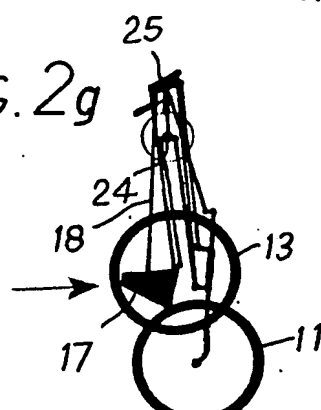


FIG. 2f

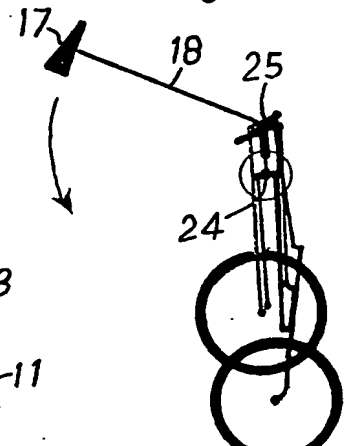


FIG. 3

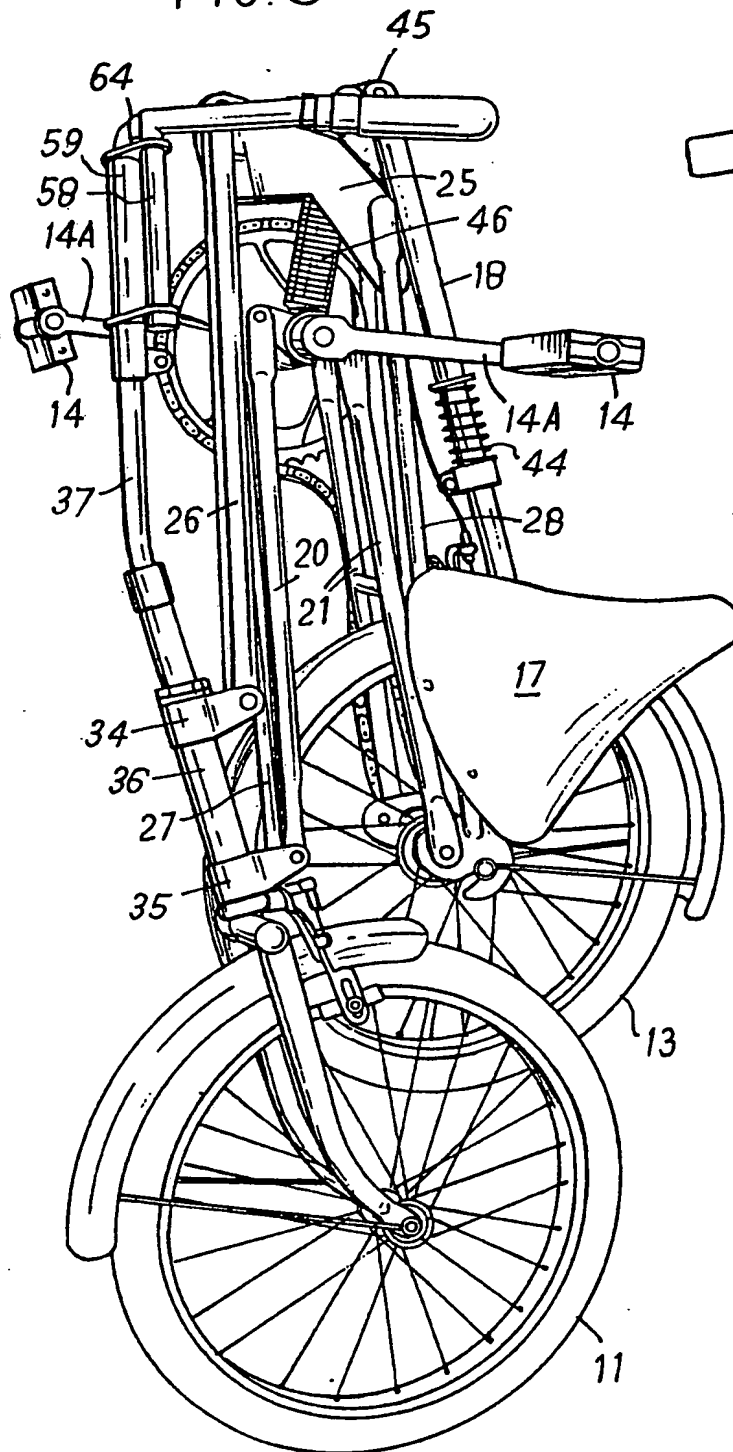


FIG. 4

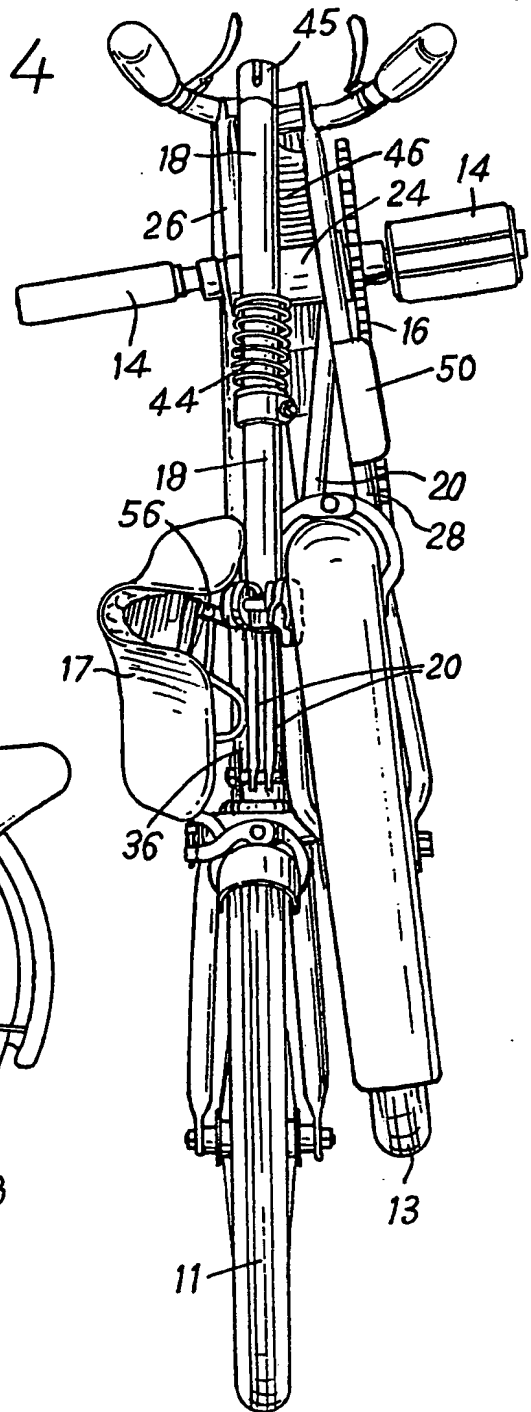
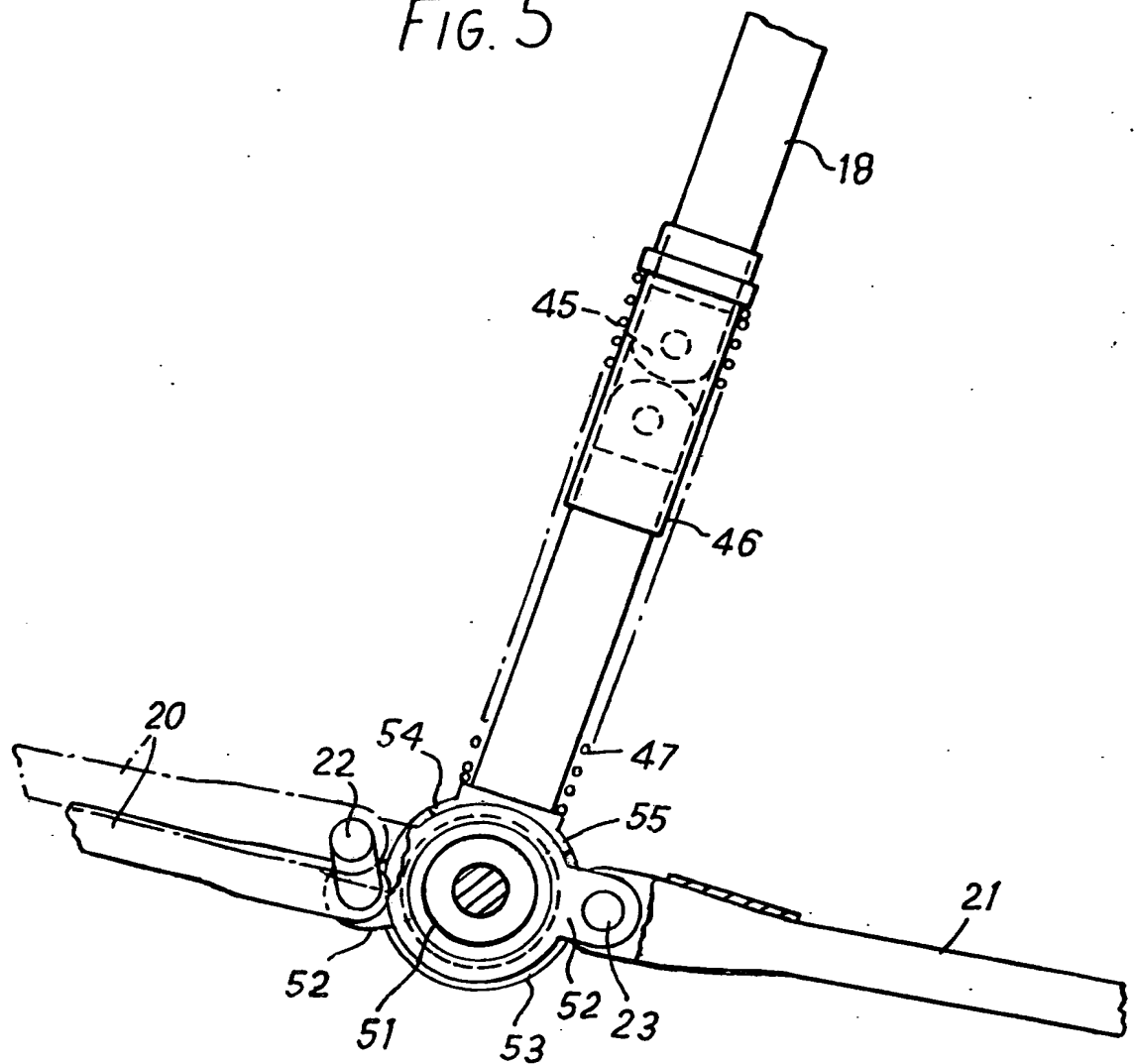
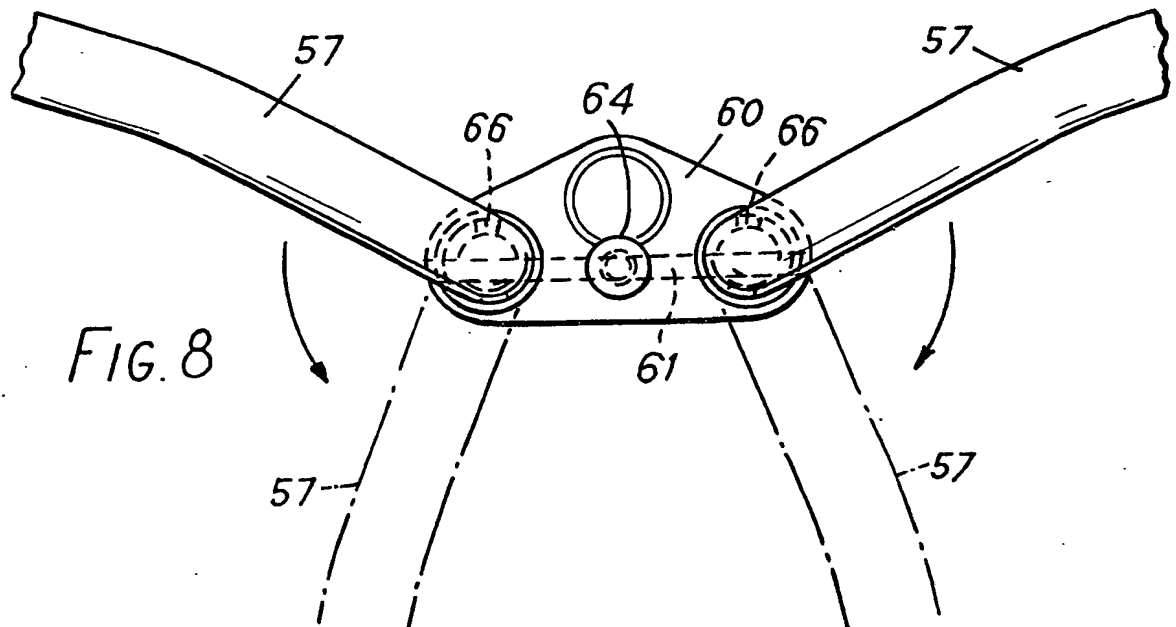
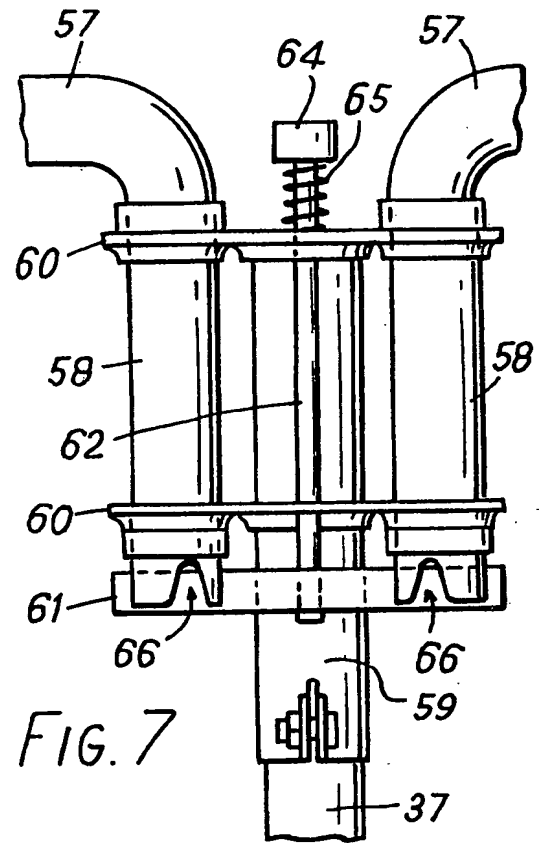
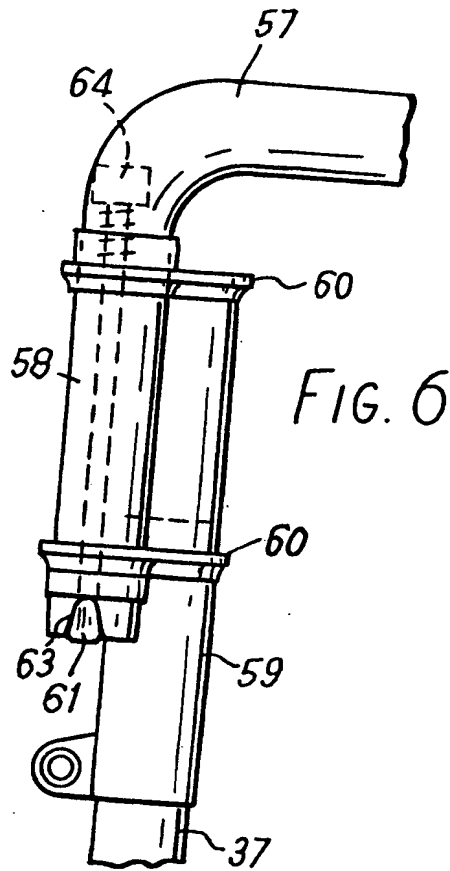


FIG. 5





## SPECIFICATION

## Folding bicycle

5 This invention relates to folding bicycles.

Folding bicycles are, of course, well-known, the usual kind having a frame which (in the upright or in-use position) hinges about a more-or-less vertical axis so that the ground wheels are swung towards one another in generally horizontal arcs. Bicycles of this kind may be quite satisfactory, but some are cumbersome to collapse and re-erect and most involve disadvantages such as the necessity to lock and unlock the frame parts and other components such as the seat column.

It is an object of the present invention to provide a folding bicycle which has a frame that folds in a novel manner and which can be collapsed and re-erected quickly and particularly simply without necessarily unfastening any frame parts.

According to the present invention there is provided a folding bicycle comprising a frame, a front wheel and handlebars at the front end of the frame, a rear wheel at the rear end of the frame, and a saddle carried at an intermediate part of the frame, characterised in that said frame comprises a base formed as generally-aligned end-to-end tie members pivotally connected at their adjacent ends to a bearing unit, an apex joint connected to the remote ends of the tie members by strut members, and a support member which extends from the bearing unit and through the apex joint and carries said saddle, said frame being collapsible on raising said support member to move said bearing unit towards said apex joint and so swing the front and rear wheels downwardly into positions alongside one another.

Suitably, selected pivotal axes of said tie and strut members are canted so that said wheels swing closely alongside one another in the folded position of the bicycle.

Preferably, said support member incorporates a hinge, so that, when fully raised, a major length of the support member can be swung downwardly to position said saddle adjacent said wheels.

Preferably also, said handlebars incorporate swivel joints so that the handlebars can be swung to folded positions.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which :

*Figure 1* is a side view showing a folding bicycle, according to the invention, in the erect or in-use position;

*Figures 2a to 2g* are diagrammatic side views illustrating the steps involved in folding the bicycle; *Figures 3* and *4* are side and front views showing the bicycle in the folded position;

*Figure 5* is a detail side view showing a bearing unit of the bicycle frame; and,

*Figures 6, 7, and 8* are detail side, front and plan views showing the handlebar hinge joints.

Referring to *Figure 1* of the drawings the folding bicycle comprises a frame 10, a front wheel 11 controlled by handlebars 12, a rear wheel 13 driven 65 by means of pedals 14 through a chain wheel 15 and

chain 16 (or alternatively a belt), and a saddle 17 supported on a column 18.

The frame 10 has a base 19 which comprises tie members 20 and 21 pivotally connected at their adjacent ends 22, 23 (*Figure 5*) to a bearing unit 24. The frame also has an apex joint bracket 25 to which struts 26, 27 and 28 are attached; the front struts 26, 27 are pivotally connected at their upper ends 29, 30 and the rear strut 28 is rigidly connected at its upper end 31. Lower ends 32, 33 of the front struts are pivotally connected to brackets 34, 35 which are clamped to a steering tube 36 that provides a bearing for handlebar stalk 37, and lower end 38 of the rear strut is rigidly connected to a pair of fork bracket plates 39 which carry the rear wheel 13. The front end of the front tie member 20 is also pivotally connected to the bracket 35, and rear end 40 of the rear tie member 21 is pivotally connected to the plates 39.

The column 18, which carries the saddle 17, passes through a sleeve-like bearing 41 pivotally mounted at 42 on the bracket 25. The column 18 is tubular and telescopically adjustable in length by means of a clamp 43, and a heavy compression spring 44 extends between the clamp and the bearing 41 to provide resilient suspension. The column 18 is also formed with a hinge 45 surrounded, in the in-use position, by a sleeve 46 which is urged upwardly by a light compression spring 47 shown in *Figure 5*.

Usual conventional accessories such as brakes 48, a multi-speed gear, a chain-(wheel) guard, lamps and carrier (not shown), may be provided, and a chain guide 49 and chain shield 50 are also provided.

As is also shown in *Figure 5*, the bearing unit 24 comprises a pedal bearing 51 to which side plates 52 are secured and around which sleeve bearing 53 for the column 18 is mounted. The bearing 53 is pivotal to facilitate folding of the frame, but limited in this movement by abutments 54, 55 which engage the roots of the side plates to prevent jamming of the tie members 20, 21 during folding.

The plates 52 carry the pivots for the inner ends of the tie members 20, 21, and it will be noted that the pivotal axis (at 22) of the front tie member 20 is canted, as are the pivotal axes at 29, 30, 33, so that the front wheel will shift laterally and lie alongside the rear wheel 13 in the folded position of the bicycle. The axle of wheel 11 is arranged to lie below the axle of wheel 13, to minimise the lateral dimensions of the folded bicycle- to this end also, the pedals 14 may be arranged to fold flat against their crank arms 14A, and the saddle 17 is mounted on the column 18 by means of a releasable pivot 56 having a fore-and-aft axis.

Referring to *Figures 6, 7 and 8*, the handlebars 12 comprise two hand-grip parts 57 formed as L-shaped tubular members carried in tubes 58 which are secured to a clamping sleeve 59 on the stalk 37 by upper and lower plates 60. The parts 57 are locked in position by means of a transverse metal bar 61 which is carried on a rod 62. In the in-use position shown in *Figures 6 to 8*, the bar enters recesses 63 in the parts 57, but can be depressed by pressing on knob 64 to move the rod 62 downwards against the

action of spring 65. The handlebars can then be swivelled to their stowed positions (shown in broken lines) where they can be locked by releasing the knob 64 and so allowing the bar to enter alternative  
 5 recesses 66. This locking arrangement may be mechanically inverted to fail safe.

When the bicycle is to be folded, from the position shown in Figure 1 to the position shown in Figures 3 and 4, the procedure illustrated in Figures 2a to 2g is  
 10 followed. The procedure involves the following steps:-

- a) The bicycle is in the in-use position (Figure 1a).
- b) The handlebars 12, with the front wheel 11,  
 15 are rotated through 180°, and the knob 64 is depressed and the hand grip parts 57 are swivelled towards one another and locked in their folded positions by releasing the knob (Figure 2b).
- c) By grasping the saddle 17 or the upper end of  
 20 the support column 18, the column 18 is raised to cause the frame base 19 to fold about unit 24 (Figure 2c).
- d) The column 18 is raised further to cause the wheels 11 and 13 to swing towards one another  
 25 (Figure 2d).
- e) The column 18 reaches its uppermost position, with the wheels alongside one another (Figure 2e).
- f) In the uppermost position of the column 18,  
 30 the sleeve 46 is displaced from around the hinge 45, having been arrested by bearing 41 at bracket 25, and the upper length of the column is then swung downwards, about the hinge 45 (Figure 2f).
- g) Finally, the saddle 17 reaches a position  
 35 adjacent the wheel 13 and is swung about its pivot 56, then released, to lie close alongside the wheel 13 (Figure 2g).

During the above folding movements, the guide 49 takes up slack in the chain 16 and, in the folded  
 40 position shown in Figures 2g, 3 and 4, the shield 50 steadies the chain and shields the chain against contact with the user.

As illustrated, the various parts of the bicycle are formed of metal, the frame being essentially of  
 45 tubular steel. However, the frame and also various other parts of the bicycle may be formed of structural plastics material, possibly in box-sections, which has the advantages of lightness, less noise in folding and unfolding, and surfaces which are less likely to  
 50 scrape.

It will be appreciated that, in the in-use position, the weight of the rider will minimise any danger of the frame folding unintentionally. It will also be appreciated that the bicycle can be collapsed quickly  
 55 and simply, with the single principal operation of lifting the saddle, to a folded position in which it is relatively easy to carry and stow. It is useful to incorporate a spring-loaded catch pin in at least the front hand-brake, so that the front wheel can be  
 60 braked to stabilise the bicycle during the folding operation and also during an unfolding operation.

Other modifications may also be made without departing from the scope of the invention. For example, as an alternative to canted axes (at 22, 29,  
 65 30, 33) the wheels may be mounted on stub shafts

extending in opposite lateral directions.

In a development of the invention, the folding-frame concept may, with appropriate modification, be applied to a tricycle or four-wheeled vehicle.

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## CLAIMS

1. A folding bicycle comprising a frame, a front wheel and handlebars at the front end of the frame, a  
 75 rear wheel at the rear end of the frame, and a saddle carried at an intermediate part of the frame, characterised in that said frame comprises a base formed as generally-aligned end-to-end tie members pivotally connected at their adjacent ends to a bearing unit, an apex joint connected to the remote ends of the tie members by strut members, and a support member which extends from the bearing unit and through the apex joint and carries said saddle, said frame being collapsible on raising said support  
 80 member to move said bearing unit towards said apex joint and so swing the front and rear wheels downwardly into positions alongside one another.

2. A folding bicycle as claimed in Claim 1, in which selected pivotal axes of said tie and strut members are canted so that said wheels swing closely alongside one another in the folding position of the bicycle.

3. A folding bicycle as claimed in Claim 1 or Claim 2, in which said support member incorporates a hinge, so that, when fully raised, a major length of the support member can be swung downwardly to position said saddle adjacent said wheels.

4. A folding bicycle as claimed in Claim 3, in which a locking member is spring-urged to immobilise said hinge, the locking member being arranged to be actuated by said apex joint as said bearing unit  
 100 nears the apex joint, thereby to free the hinge.

5. A folding bicycle as claimed in any preceding Claim, in which said handlebars incorporate swivel joints so that the handlebars can be swung to folded positions.

6. A folding bicycle as claimed in Claim 5, in which said handlebars comprise a pair of hand-grip members which are locked in alternative in-use and folded positions by means which are spring-loaded into engagement with selected recesses in the hand-grip members.

7. A folding bicycle as claimed in any preceding Claim, in which said saddle is mounted on a fore-and-aft pivotal axis, thereby enabling the saddle to lie close alongside said wheels in the folded position of the bicycle.

8. A folding bicycle as claimed in any preceding Claim, in which said strut members comprise a front pair of struts pivotally connected at their upper ends to said hinge joint and having pivotal connections at their lower ends with a bearing tube for said handlebars, and a rear strut which extends between the hinge joint and support bracket means for said  
 120 rear wheel, said front tie member having a pivotal connection with the bearing tube and said rear tie member being pivotally connected to the support bracket means.

9. A folding bicycle as claimed in any preceding Claim, in which a chain guide is mounted on said  
 130



bearing unit to move with the bearing unit and so take up slack in the chain during folding of the bicycle.

10. A folding bicycle as claimed in any preceding Claim, in which a catch is incorporated in a handbrake of the bicycle to permit automatic locking of at least one of the wheels during folding and unfolding of the bicycle.

11. A folding bicycle, substantially as hereinbefore described with reference to the accompanying drawings.

12. The features herein described, or their equivalents, in any novel selection.

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